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(57) Abstract

The present invention is a method for producing a chewing gum with a delayed release of a combination of sweeteners, as well as the chewing gum so produced. The delayed release sweetener combination is obtained by physically modifying the properties of the combination of aspartame and acesulfame K by coating and drying. The sweetener combination is coated by encapsulation, partially coated by agglomeration entrapped by absorption or treated by multiple steps of encapsulation, agglomeration, and absorption. The coated sweetener combination is then codried and particle sized to produce a release-modified aspartame/acesulfame K high-intensity sweetener combination. When incorporated into gum, these particles are adapted to enhance the shelf stability of the sweeteners and/or produce a delayed release when the gum is chewed.

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CHEWING GUM CONTAINING ENCAPSULATED COMBINATIONS OF ASPARTAME AND ACESULFAME K

BACKGROUND OF THE INVENTION

The present invention relates to chewing gum compositions and methods of producing chewing gum. More particularly the invention relates to producing chewing gum containing high-intensity sweeteners which have been treated to control their release and enhance shelf life stability.

Efforts have been directed at perfecting the use of high-intensity sweeteners within chewing gum formulations, to thereby increase the shelf life stability of the ingredients, i.e., the protection against degradation of the high-intensity sweetener over time.

Two such high-intensity sweeteners are aspartame, and acesulfame K (6-methyl-1,2,3-oxathiazine-4(3H)-one-2,2-dioxide potassium salt). These sweeteners, which have been approved for use in food products in over 20 different countries, have also been approved for use in chewing gum by the FDA as a food additive. Acesulfame K gives chewing gum a fast, strong release that is not desirable. Methods of treating acesulfame K in combination with other high-intensity sweeteners to delay the release or sweetness in balance with the chewing gum flavor would therefore be a definite improvement.

In recent years, efforts have been devoted to controlling release characteristics of various ingredients in chewing gum. Efforts have been directed at perfecting the use of high-intensity sweeteners within

the chewing gum formulation, to thereby increase the shelf-life stability of the ingredients, i.e., the protection against degradation of the high-potency sweetener over time.

Several patents disclose the use of acesulfame K and aspartame separately. German Patent No. 3,120,837 discloses simply addition of acesulfame K in gum at levels from 0.01% to 3%.

Patent Cooperation Treaty Publication No. 89-03170 discloses a method of controlling the release of acesulfame K. In this process, the sweetener is encapsulated fully or partially to modify the release rate in chewing gum.

U.S. Patent No. 4,374,122 relates to the use of acesulfame K in a sugar-containing chewing gum to reduce or prevent caries in the presence of fermentable carbohydrates.

U.S. Patent No. 4,158,086 discloses sweetener mixtures for use in foods, beverages, and pharmaceuticals but not specifically chewing gums.

U.K. Patent No. 2,154,850 discloses beverages sweetened with sucralose and acesulfame K (among others).

U.K. Patent No. 2,185,674 discloses combinations of thaumatin and acesulfame K (among others) to stimulate growth of farm animals.

U.S. Patent No. 4,536,396 discloses synergistic combinations of alitame and acesulfame K in foods, including chewing gum.

U.S. Patent No. 4,746,520 discloses sweetener compositions which preferentially include acesulfame K along with a sugar or sugar alcohol, a food acid and bicarbonate.

Other patents disclose how a sweetener like aspartame can be physically modified to control its release rate in chewing gum.

For example, U.S. Patent No. 4,597,970 to Sharma et al. teaches a process for producing an

agglomerated sweetener wherein the sweetener is dispersed in a hydrophobic matrix consisting essentially of lecithin, a glyceride and a fatty acid or wax having a melting point between 25 and 100°C. The method disclosed uses a spray congealing step to form the sweetener-containing matrix into droplets, followed by a fluid-bed second coating on the agglomerated particles.

U.S. Patent Nos. 4,515,769 and 4,386,106, both to Merrit et al., teach a two step process for preparing a delayed release flavorant for chewing gum. In this process, the flavorant is prepared in an emulsion with a hydrophilic matrix. The emulsion is dried and ground and the particles are then coated with a water-impermeable substance.

U.S. Patent No. 4,230,687 to Sair et al. teaches a process for encasing an active ingredient to achieve gradual release of the ingredient in a product such as chewing gum. The method described involves adding the ingredient to an encapsulating material in the form of a viscous paste. High shear mixing is used to achieve a homogeneous dispersion of the ingredient within the matrix, which is subsequently dried and ground.

U.S. Patent No. 4,139,639 to Bahoshy et al. teaches a process of "fixing" aspartame by co-drying (by spray drying or fluid bed coating) a solution containing aspartame and an encapsulating agent, such as gum arabic, to thereby surround and protect the aspartame in the gum during storage.

U.S. Patent No. 4,384,004 to Cea et al. teaches a method of encapsulating aspartame with various solutions of encapsulating agents using various encapsulation techniques, such as spray drying, in order to increase the shelf stability of the aspartame.

U.S. Patent No. 4,634,593 to Stroz et al. teaches a method for producing controlled release sweeteners for confections, such as chewing gum. The

method taught therein involves the use of an insoluble fat material which is mix mulled with the sweetener.

U.S. Patent No. 3,780,189 to Scott discloses compositions comprising aspartame and saccharin.

SUMMARY OF THE INVENTION

The present invention is a method for producing chewing gum with a modified high-potency sweetener, containing combinations of aspartame and acesulfame K. The delayed release high-intensity sweetener is obtained by modifying the sweetener by encapsulation, partial encapsulation or partial coating, entrapment or absorption with low-water-soluble materials or water-insoluble materials. The procedures for modifying the sweetener include spray drying, spray chilling, fluid-bed coating, coacervation, and other agglomerating and standard encapsulating techniques. The sweetener may also be absorbed onto an inert or water-insoluble material. The sweeteners may be modified in a multiple step process comprising any of the processes noted.

These sweeteners, aspartame and acesulfame K, when modified according to the present invention, give a chewing gum a controlled-release sweetener. A higher quantity of sweetener can be used without resulting in a high initial sweetness impact, but instead having a delayed sweetness release in chewing gum, giving a highly consumer-acceptable chewing gum product.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Acesulfame K (potassium salt of 6-methyl-1,2,3-oxathiazine-4(3H)-one-2,2-dioxide) is a high-intensity sweetener which is about 200 times sweeter than sugar. The taste properties of acesulfame K are considered good. At concentrations usually used, acesulfame K has a pure and rapidly perceptible sweet taste that does not linger.

Acesulfame K is approved for use in chewing gum by many foreign countries and approved for chewing gum by

the United States Food and Drug Administration as a food additive. The manufacturer of acesulfame K is the Hoechst Celanese Corporation of Somerville, New Jersey. Acesulfame K is sold under the trade name of "Sunett."

Aspartame, methylester of L-aspartyl-L-phenylalanine, is a high-intensity sweetener which is about 200 times sweeter than sugar. The relative sweetness varies with the flavor system, pH, tasting temperature, and the amount of sucrose or other sugars being replaced. Aspartame has a clean, sweet taste like sugar without the bitter chemical or metallic after taste often associated with artificial sweeteners.

Aspartame is approved for use in chewing gum by the U.S. Food and Drug Administration. The manufacturer of aspartame is G.D. Searle & Co., and is also sold under the trade name "Nutrasweet". In addition to the United States, aspartame has been approved for food and beverage and/or tabletop sweetener use in over 50 countries.

Aspartame and acesulfame K release very quickly from chewing gum during the early stages of mastication of the gum because of their high solubility in water. Physical modifications of the sweeteners by encapsulation with another substrate will slow their release in chewing gum by reducing the solubility or dissolution rate of aspartame and acesulfame K. Any standard technique which gives partial or full encapsulation of the combination of aspartame and acesulfame K can be used. These techniques include, but are not limited to, spray drying, spray chilling, fluid-bed coating and coacervation. These encapsulation techniques that give partial encapsulation or full encapsulation can be used individually or in any combination in a single step process or multiple step process. Generally, delayed release of sweeteners is obtained in multistep processes like spray drying the combined sweetener and then fluid-bed coating of the resultant powder.

The encapsulation techniques here described are standard coating techniques and generally give varying degrees of coating from partial to full coating, depending on the coating composition used in the process. Also, the coating compositions may be susceptible to water permeation to various degrees. Generally, compositions that have high organic solubility, good film forming properties and low water solubility give better delayed release of the sweetener. Such compositions include acrylic polymers and copolymers, carboxyvinyl polymer, polyamides, polystyrene, polyvinyl acetate, polyvinyl acetate phthalate, polyvinyl pyrrolidone and waxes. Although all of these materials are possible for encapsulation of combinations of aspartame and acesulfame K sweeteners, only food grade materials should be considered. Two standard food grade coating materials that are good film formers but not water soluble are shellac and zein. Others which are more water soluble, but good film formers, are materials like agar, alginates, a wide range of cellulose derivative like ethyl cellulose and hydroxypropylmethyl cellulose, dextrin, gelatin and modified starches. These ingredients, which are generally approved for food use, also give a delayed release when used as an encapsulant for the sweetener combination. Other encapsulants like acacia or maltodextrin can also encapsulate the sweetener combination, but give very little change in the release rate of the sweetener combinations in gum.

The amount of coating or encapsulating material on the sweetener combination also controls the length of time for its release from chewing gum. Generally, the higher the level of coating and the lower the amount of active sweetener combination, the slower the release of the sweetener during mastication. The release rate is generally not instantaneous, but gradual over an extended period of time. To obtain the desired sweetness release to blend with a gum's flavor release, the encapsulant

should be a minimum of about 20% of the coated sweetener. Preferably, the encapsulant should be a minimum of about 30% of the coated sweetener, and most preferably should be a minimum of about 40% of the coated sweetener. Depending on the coating material, a higher or lower amount of coating material may be needed to give the desired release of sweetener to balance sweetness release with flavor release.

Another method of giving a delayed release of the sweetener combination of aspartame and acesulfame K is agglomeration of the sweeteners with an agglomerating agent which partially coats the sweetener. This method includes the step of melting the sweetener and agglomerating agent with a small amount of water or solvent. The mixture is prepared in such a way as to have individual wet particles in contact with each other so a partial coating can be applied. After the water or solvent is removed, the mixture is ground and used as a powdered coated sweetener.

Materials that can be used as the agglomerating agent are the same as those used in the encapsulation mentioned previously. However, since the coating is only a partial encapsulation and the sweetener combination is very water soluble, some agglomeration agents are more effective in delaying the sweeteners' release than others. Some of the better agglomerating agents are the organic polymers like acrylic polymer and copolymers, polyvinyl acetate, polyvinyl-pyrrolidone, waxes, shellac and zein. Other agglomerating agents are not as effective in giving the sweetener a delayed release as are the polymers, waxes, shellac and zein but can be used to give some delayed release. These others agglomerating agents include, but are not limited to, agar, alginates, a wide range of cellulose derivatives, dextrin, gelatin, modified starches, and vegetable gums like guar gums, locust bean gum, and carrageenin. Even though the agglomerated sweetener is only partially coated, when the

quantity of coating is increased compared to the quantity of the sweetener combination, the release of the sweetener can be delayed for a longer time during mastication. The level of coating used in the agglomerated product is a minimum of about 5%. Preferably the coating level is a minimum of about 15%, and more preferably about 20%. Depending on the agglomerating agent, a higher or lower amount of agent may be needed to give the desired release of sweetener to balance sweetness release with flavor release.

The aspartame/acesulfame K sweetener combination may be coated in a two-step process or multiple step process. The sweetener combination may be encapsulated with any of the materials as described previously and then the encapsulated sweetener can be agglomerated as described previously to obtain an encapsulated/agglomerated sweetener product that could be used in chewing gum to give a delayed release of sweetener.

In another embodiment of this invention, the aspartame/acesulfame K sweetener combination may be absorbed onto another component which is porous and become entrapped in the matrix of the porous component. Common materials used for absorbing the sweetener combination include, but are not limited to, silicas, silicates, pharmasorb-clay, sponge-like beads or microbeads, amorphous carbonates and hydroxides, including aluminum and calcium lakes, vegetable gums and other spray dried materials.

Depending on the type of absorbent material and how it is prepared, the amount of the sweetener combination that can be loaded onto the absorbent will vary. Generally materials like polymers or spongelike beads or microbeads, amorphous sugars, and alditols and amorphous carbonates and hydroxides absorb about 10% to about 40% of the weight of the absorbent. Other materials like silicas and pharmasorb clays may be able

to absorb about 20% to about 80% of the weight of the absorbent.

The general procedure for absorbing the sweetener onto the absorbent is as follows. An absorbent like formed silica powder can be mixed in a powder blender and an aqueous solution of the sweetener combination can be sprayed onto the powder as mixing continues. The aqueous solution can be about 5% to 30% sweetener solids, and higher solid levels may be used if temperatures up to 90° C. are used. Generally water is the solvent, but other solvents like alcohol could also be used if approved for use in food. As the powder mixes, the liquid is sprayed onto the powder. Spraying is stopped before the mix becomes damp. The still flowing powder is removed from the mixer and dried to remove the water or other solvent, and ground to a specific particle size.

After the aspartame/acesulfame K sweetener combination is absorbed onto an absorbent or fixed onto an absorbent, the fixative/sweetener can be coated by encapsulation. Either full or partial encapsulation may be used, depending on the coating composition used in the process. Full encapsulation may be obtained by coating with a polymer as in spray drying, spray chilling, fluid-bed coating, coacervation, or any other standard technique. A partial encapsulation or coating can be obtained by agglomeration of the fixative/sweetener mixture using any of the materials discussed above.

The three methods to use to obtain a delayed release of aspartame/acesulfame K sweetener combination are (1) encapsulation by spray drying, fluid-bed coating, spray chilling and coacervation to give full or partial encapsulation; (2) agglomeration to give partial encapsulation; and (3) fixation or entrapment/absorption which also gives partial encapsulation. These three methods, combined in any usable manner which physically isolates the sweetener combination, reduces its

dissolvability or slows down the release of sweetener are included in this invention.

The previously described encapsulated, agglomerated, or absorbed high-intensity sweetener may readily be incorporated into a chewing gum composition. The remainder of the chewing gum ingredients are noncritical to the present invention. That is, the coated particles of high-intensity sweetener combination can be incorporated into conventional chewing gum formulations in a conventional manner. Naturally, the preferred chewing gum formulation is a sugarless formulation. However, the high-intensity sweetener combination may also be used in a sugar chewing gum to intensify and/or extend the sweetness thereof. The coated high-intensity sweetener may be used in either regular chewing gum or bubble gum.

In generally, a chewing gum composition typically comprises a water-soluble bulk portion, a water-insoluble chewable gum base portion and typically water-insoluble flavoring agents. The water-soluble portion dissipates with a portion of the flavoring agent over a period of time during chewing. The gum base portion is retained in the mouth throughout the chew.

The insoluble gum base generally comprises elastomers, resins, fats and oils, waxes, softeners and inorganic fillers. Elastomers may include polyisobutylene, isobutylene-isoprene copolymer and styrene butadiene rubber, as well as natural latexes such as chicle. Resins include polyvinyl acetate and terpene resins. Fats and oils may also be included in the gum base, including tallow, hydrogenated and partially hydrogenated vegetable oils and cocoa butter, commonly employed waxes such as beeswax and carnauba. According to the preferred embodiment of the present invention, the insoluble gum base constitutes between about 5-to about 95% by weight of the gum. More preferably the insoluble gum base comprises between 10 and 50 percent by weight of

the gum and most preferably about 20 to 35% by weight of the gum.

The gum base typically also includes a filler component. The filler component may be calcium carbonate, magnesium carbonate, talc, dicalcium phosphate or the like. The filler may constitute between about 5 and about 60% by weight of the gum base. Preferably the filler comprises about 5 to 50% by weight of the gum base.

Gum bases typically also contain softeners including glycerol monostearate and glycerol triacetate. Gum bases may also contain optional ingredients such as antioxidants, colors, and emulsifiers. The present invention contemplates employing any commercially acceptable gum base.

The water-soluble portion of the chewing gum may further comprise softeners, sweeteners, flavoring agents and combinations thereof. Softeners are added to the chewing gum in order to optimize the chewability and mouthfeel of the gum. Softeners, also known in the art as plasticizers or plasticizing agents, generally constitute between about 0.5 to about 15% by weight of the chewing gum. Softeners contemplated by the present invention include glycerin, lecithin and combinations thereof. Further, aqueous sweetener solutions such as those containing sorbitol, hydrogenate starch hydrolysate, corn syrup and combinations thereof may be used as softeners and binding agents in gum.

As mentioned above, the coated high-intensity sweeteners of the present invention will most likely be used in sugarless gum formulations. However, formulations containing sugar are also within the scope of the invention. Sugar sweeteners generally include saccharide-containing components commonly known in the chewing gum art which comprise, but are not limited to, sucrose, dextrose, maltose, dextrin, dried invert sugar,

fructose, levulose, galactose, corn syrup solids and the like, alone or in any combination.

The coated high-intensity sweeteners of the present invention can also be used in combination with other sugarless sweeteners. Generally sugarless sweeteners include components with sweetening characteristics but which are devoid of the commonly known sugars and comprise, but are not limited to, sugar alcohols such as sorbitol, mannitol, xylitol, hydrogenated starch hydrolysate, maltitol and the like alone or in any combination.

The flavoring agent may be present in the chewing gum in an amount within the range of from about 0.1 to about 10 weight percent and preferably from about 0.5 to about 3.0 weight percent of the gum. The flavoring agents may comprise essential oils, synthetic flavors, or mixture thereof including, but not limited to, oils derived from plants and fruits such as citrus oils, fruit essences, peppermint oil, spearmint oil, clove oil, oil of wintergreen, anise, and the like. Artificial flavoring components are also contemplated for use in gums of the present invention. Those skilled in the art will recognize that natural and artificial flavoring agents may be combined in any sensorially acceptable blend. All such flavors and flavor blends are contemplated by the present invention.

Optional ingredients such as colors, emulsifiers and pharmaceutical agents may be added to the chewing gums. In generally, chewing gum is manufactured by sequentially adding the various chewing gum ingredients to a commercially available mixer known in the art. After the ingredients have been thoroughly mixed, the gum mass is discharged from the mixer and shaped into the desired form such as by rolling into sheets and cutting into sticks, extruding into chunks or casting into pellets.

Generally, the ingredients are mixed by first melting the gum base and adding it to the running mixer. The base may also be melted in the mixer itself. Color or emulsifiers may also be added at this time, along with syrup and a portion of the bulking agent. Further portions of the bulking agent may then be added to the mixer. A flavoring agent is typically added with the final portion of the bulking agent. The coated sweetener of the present invention is preferably added after the final portion of bulking agent and flavor have been added. The entire mixing procedure typically takes from five to fifteen minutes, but longer mixing times may sometime be required. Those skilled in the art will recognize that many variations of the above described procedures may be followed.

Examples

TABLE 1
Regular-Tack Sugarless Gum (Percentage by Weight)

	Ex. 1	Ex. 2	Ex. 3	Ex. 4	Ex. 5
Sorbitol	50.0	50.0	50.0	50.0	50.0
Gum Base	24.7	24.7	24.7	24.7	24.7
Lecithin	0.2	0.2	0.18	0.18	0.18
Glycerin	2.0	2.0	2.0	5.0	8.0
Lycasin	14.4	12.0	12.0	9.0	6.0
Mannitol	7.0	9.4	9.38	9.38	9.38
Peppermint Flavor	1.4	1.4	1.44	1.44	1.44
Encapsulated Aspartame/ Acesulfame K	0.3	0.3	0.3	0.3	0.3

TABLE 2
Regular-Tack Sugarless Gum (Percentage by Weight)

	Ex. 6	Ex. 7	Ex. 8	Ex. 9	Ex. 10
Sorbitol	49.35	48.65	49.35	49.35	49.35
Gum Base	25.5	25.5	25.5	25.5	25.5
Lecithin	0.2	0.2	0.2	0.2	0.2
Glycerin	8.5	8.5	4.7	4.7	8.5
Liquid Sorbitol	6.8	6.8	6.8	6.8	3.0
Mannitol	8.0	8.0	8.0	8.0	8.0
Encapsulated Aspartame/ Acesulfame K	0.2	0.9	4.0	4.0	4.0
Peppermint Flavor	1.45	1.45	1.45	1.45	1.45

Example 1

This example contains a sweetener composition which has a 2% aspartame and 98% acesulfame K coated with polyvinyl-acetate.

Example 2

This example contains a sweetener composition containing 7% aspartame and 93% acesulfame K agglomerated with carboxymethyl cellulose.

Example 3

This example contains a sweetener composition which has 10% aspartame and 90% acesulfame K coated with carboxyvinyl polymer.

Example 4

This example contains a sweetener composition which has 12% aspartame and 88% acesulfame K absorbed onto silica.

Example 5

This example contains a sweetener composition which has 15% aspartame and 85% acesulfame K agglomerated with guar gum.

Example 6

This example contains a sweetener composition which has 17% aspartame and 83% acesulfame K agglomerated with polyvinyl acetate.

Example 7

This example contains a sweetener composition which has 20% aspartame and 80% acesulfame K coated with polyvinyl pyrrolidone.

Example 8

This example contains a sweetener composition which has 23% aspartame and 77% acesulfame K absorbed onto microbeads.

Example 9

This example contains a sweetener composition which has 25% aspartame and 75% acesulfame K coated with polystyrene.

Example 10

This example contains a sweetener composition which has 30% aspartame and 70% acesulfame K coated with polyvinyl acetate phthalate.

TABLE 3
Regular-Tack Sugarless Gum (Percentage by Weight)

	Ex. 11	Ex. 12	Ex. 13	Ex. 14	Ex. 15
Sorbitol	60.81	55.0	61.4	55.19	52.73
Gum Base	24.0	27.11	21.21	29.48	22.58
Mannitol	2.1	3.1	3.11	2.66	2.0
Glycerin	4.7	4.11	12.11	3.11	11.61
Sorbitol Solution	6.42	---	---	---	---
Lecithin	0.10	0.15	0.20	---	0.10
Evaporated Lycasin/ Glycerin	---	9.16	---	8.11	8.88
Alitame	0.4	0.22	---	0.03	---
Encapsulated Aspartame/ Acesulfame K	0.4	0.15	1.0	0.22	0.90
Peppermint Flavor	---	---	0.97	---	---
Citrus Oil	1.07	---	---	---	---
Wintergreen Oil	---	1.0	---	---	---
Peppermint Oil	---	---	---	1.2	1.2

TABLE 4
Regular-Tack Sugarless Gum (Percentage by Weight)

	Ex. 16	Ex. 17	Ex. 18	Ex. 19	Ex. 20
Sorbitol	62.90	64.61	59.92	63.11	60.59
Gum Base	29.48	20.97	26.00	27.08	22.07
Lecithin	0.13	0.14	0.10	0.10	---
Glycerin	4.11	2.0	12.11	5.9	12.00
Mannitol	1.77	10.0	---	2.01	3.11
Encapsulated Alitame	---	0.04	---	---	0.04
Encapsulated Sucralose	0.11	---	0.15	---	---
Encapsulated Aspartame/ Acesulfame K	0.55	1.25	0.46	0.80	0.75
Cinnamon Flavor	0.95	---	---	---	---
Wintergreen Flavor	---	0.99	---	---	1.44
Peppermint Flavor	---	---	1.26	1.00	---

Example 11

This example contains a sweetener composition which has 33% aspartame and 67% acesulfame K agglomerated with hydroxypropylmethyl cellulose.

Example 12

This example contains a sweetener composition which has 35% aspartame and 65% acesulfame K coated with zein.

Example 13

This example contains a sweetener composition which has 38% aspartame and 62% acesulfame K coated with hydroxymethyl cellulose.

Example 14

This example contains a sweetener composition which has 40% aspartame and 60% acesulfame K absorbed onto pharmasorb clay.

Example 15

This example contains a sweetener composition which has 42% aspartame and 58% acesulfame K absorbed onto gelatin.

Example 16

This example contains a sweetener composition which has 45% aspartame and 55% acesulfame K absorbed onto sorbitol.

Example 17

This example contains a sweetener composition which has 48% aspartame and 52% acesulfame K coated with shellac.

Example 18

This example contains a sweetener composition which has 50% aspartame and 50% acesulfame K which is coated with ethyl cellulose.

Example 19

This example contains a sweetener composition which has 52% aspartame and 48% acesulfame K which is agglomerated with hydroxymethyl cellulose.

TABLE 5
Sugarless Pellet Gums For Coating (Percentage by Weight)

	Ex. 21	Ex. 22	Ex. 23	Ex. 24	Ex. 25
Sorbitol	51.16	43.87	44.92	43.81	46.33
Gum Base	31.01	33.00	32.71	33.03	30.97
Glycerin	6.14	8.00	8.00	7.98	7.82
Free Aspartame	0.06	---	0.10	---	0.08
Encapsulated Aspartame/ Acesulfame K	0.42	0.33	0.85	0.25	0.54
Calcium Carbonate	10.01	13.00	12.16	12.93	13.04
Peppermint Flavor	---	1.30	0.17	---	1.01
Menthol	---	0.50	---	---	0.21
Fruit Flavor	---	---	---	1.50	---
Lemon Flavor	---	---	---	0.50	---
Encapsulated Menthol	---	---	---	---	---
Spearmint Flavor	1.20	---	1.09	---	---

TABLE 6
Sugarless Bubble Gums (Percentage by Weight)

	Ex. 26	Ex. 27	Ex. 28	Ex. 29	Ex. 30
Sorbitol	56.65	56.09	50.42	53.34	48.63
Gum Base	24.00	24.59	28.00	29.12	30.10
Lecithin	1.00	0.91	0.89	0.61	0.86
Fruit Flavor	1.20	1.41	---	---	1.11
Grape Flavor	---	---	1.71	---	---
Strawberry Flavor	---	---	---	1.34	---
Evaporated Lycasin/Glycerin	---	6.79	9.61	---	10.41
Glycerin	17.00	10.00	9.00	15.09	8.21
Free Aspartame	0.04	---	0.06	---	0.17
Sucralose	---	---	---	0.09	---
Encapsulated Aspartame/ Acesulfame K	0.11	0.21	0.31	0.41	0.51

Example 21

This example contains a sweetener composition which has 55% aspartame and 45% acesulfame K absorbed onto sucralose.

Example 22

This example contains a sweetener composition which has 58% aspartame and 42% acesulfame K coated with dextrin.

Example 23

This example contains a sweetener composition which has 60% aspartame and 40% acesulfame K coated with maltodextrin.

Example 24

This example contains a sweetener composition which has 62% aspartame and 38% acesulfame K agglomerated with zein.

Example 25

This example contains a sweetener composition which has 65% aspartame and 35% acesulfame K agglomerated with shellac.

Example 26

This example contains a sweetener composition which has 68% aspartame and 32% acesulfame K coated with emulsified acetate.

Example 27

This example contains a sweetener composition which has 70% aspartame and 30% acesulfame K absorbed onto dextrose.

Example 28

This example contains a sweetener composition which has 73% aspartame 27% acesulfame K coated with sodium hydroxymethyl cellulose.

Example 29

This example contains a sweetener composition which has 75% aspartame and 25% acesulfame K coated with carboxyvinyl polymer.

Example 30

This example contains a sweetener composition which has 78% aspartame and 22% acesulfame K coated with zein.

TABLE 7
Regular Tack Sugar Gums (Percentage by Weight)

	Ex. 31	Ex. 32	Ex. 33	Ex. 34	Ex. 35
Sugar	58.29	59.26	62.49	59.97	56.61
Gum Base	22.38	20.60	20.08	23.17	26.80
Corn Syrup	17.20	18.50	15.40	14.70	13.88
Glycerin	1.09	0.83	1.00	1.00	1.05
Encapsulated Aspartame/ Acesulfame K	0.10	0.20	0.15	0.25	0.45
Lecithin	0.05	0.03	0.02	---	---
Peppermint Flavor	0.89	0.58	0.86	0.91	1.21

TABLE 8
Regular Tack Sugar Gums (Percentage by Weight)

	Ex. 36	Ex. 37	Ex. 38	Ex. 39	Ex. 40
Sugar	54.3	45.3	49.3	40.3	45.3
Gum Base	19.2	19.2	19.2	19.2	19.2
Glycerin	1.4	1.4	1.4	1.4	1.4
Corn Syrup	19.0	23.0	19.0	19.0	23.0
Dextrose	---	5.0	---	---	---
Lactose	5.0	---	---	---	---
Fructose	---	5.0	---	---	---
Invert Sugar	---	---	10.0	---	---
Maltose	---	---	---	10.0	---
Palatinose	---	---	---	---	10.0
Spearmint Flavor	0.9	0.9	0.9	9.9	0.9
Encapsulated Aspartame/ Acesulfame K	0.2	0.2	0.2	0.2	0.2

Example 31

This example contains a sweetener composition which has 80% aspartame and 20% acesulfame K agglomerated with carrageenin.

Example 32

This example contains a sweetener composition which has 83% aspartame and 17% aspartame coated with gelatin.

Example 33

This example contains a sweetener composition which has 85% aspartame and 15% methyl cellulose coated with polyvinyl acetate.

Example 34

This example contains a sweetener composition which has 87% aspartame and 13% acesulfame K coated with maltodextrin.

Example 35

This example contains a sweetener composition which has 90% aspartame and 10% acesulfame K agglomerated with dextrose.

Example 36

This example contains a sweetener composition which has 92% aspartame and 8% acesulfame K absorbed onto silica.

Example 37

This example contains a sweetener composition which has 94% aspartame and 6% acesulfame K coated with polystyrene.

Example 38

This example contains a sweetener composition which has 95% aspartame and 5% acesulfame K coated with shellac.

Example 39

This example contains a sweetener composition which has 96% aspartame and 4% acesulfame K coated with polyvinyl pyrrolidone.

Example 40

This example contains a sweetener composition which has 98% aspartame and 2% acesulfame K coated with ethylcellulose.

It should be appreciated that the compositions and methods of the present invention are capable of being incorporated in the form of a variety of embodiments, only a few of which have been illustrated and described above. The invention may be embodied in other forms without departing from its spirit or essential characteristics. The described embodiments are to be considered in all respects only as illustrative and not restrictive, and the scope of the invention is therefore indicated by the appended claims rather than by the foregoing descriptions. All changes which come within the meaning and range of equivalency of the claims are to be embraced within their scope.

We Claim:

1. A method of producing chewing gum with a sweetener combination of aspartame and acesulfame K comprising the steps of:

a) mixing a quantity of aspartame and acesulfame K together with a spray drying solvent and an encapsulating material;

b) spray drying the mixture in such a way as to encapsulate the aspartame and acesulfame K; and

c) adding a quantity of the spray dried material to a chewing gum formulation to provide an aspartame and acesulfame K level in the gum from about 0.05% to 1.0%.

2. The method of Claim 1 wherein the solvent is selected from the group consisting of alcohol and water.

3. A chewing gum made according to the method of claim 1.

4. A method of producing chewing gum with a sweetener combination of aspartame and acesulfame K comprising the steps of:

a) fluid-bed coating the aspartame/acesulfame K mixture with a solution of an encapsulating material and a solvent;

b) drying said fluid-bed coated material; and

c) adding a quantity of the fluid-bed coated material to a chewing gum formulation to provide an aspartame/acesulfame K level in the gum formulation of form about 0.05% to about 1.0%.

5. The method of claim 4 wherein the solvent is selected from the group consisting of alcohol and water.

6. A chewing gum made according to the method of claim 4.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US94/14433

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :A23G 3/30
US CL :426/3

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 426/3, 4, 5, 6, 96, 453

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

APS
search terms: chewing gum, aspartame, ascesulfame, encapsulated, spray dry, fluid bed

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US, A, 5,112,625 (ZIBELL ET AL) 12 May 1992, see abstr, col. 3, lines 58-68 and examples.	1-6
A	US, A, 5,164,210 (CAMPBELL ET AL) 17 November 1992.	1-6
Y	US, A, 5,227,182 (SONG ET AL) 13 July 1993, see abst, col. 7, lines 5-18 and examples.	1-6
A	US, A, 5,336,509 (MCGREW ET AL) 09 August 1994, see col. 15, lines 13 and 48-60 and claim 2.	1-6
Y	US, A, 4,139,639 (BAHOSHY ET AL) 13 February 1979, see entire document.	1-6

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be part of particular relevance

"E" earlier document published on or after the international filing date

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

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